



**Steerable wireline
core barrel**

Description

The DeviDrill is an innovative directional core barrel based on the wireline core drilling technology used in exploration drilling. It drills the hole in a curve while at the same time collecting a 3m/10ft core sample, leading to the application name, Directional Core Drilling (DCD).

The DeviDrill fits directly to the standard drill string and is fully compatible with the N-size wireline system. There is no need for additional water pumps, drill strings, or survey instruments, with Devico's integrated survey instruments providing onboard orientation and directional measurement.

Coring while steering provides a complete record of the geology. It leaves nothing in the hole – except a curve. The curvature or dogleg can be adjusted from zero to more than 20 deg/30 meters but is typically aimed at 9 deg/30 meters, which is the recommended curvature from most drill rod manufacturers.

The principle behind the DeviDrill directional core barrel is a drive shaft running through a bushing offset from the center line of the tool. Expanding pads operated by differential pressure keep the DeviDrill in a fixed orientation while drilling in a curve.

The inner assembly carries an inner tube collecting the core sample, an orientation system, and a wireless instrument barrel with the survey tool recording inclination and orientation. Orientation data is stored inside the survey tool and made available to the field engineers after each drill run (3m/10ft).

Advantages

Compared to standard wireline drilling (re-drilling from surface)

- Reduced drilling length and fewer drill sites
- Less environmental impact
- Full control over natural deviation
- Improved borehole accuracy with intersection of targets at optimal angles
- Reduced wear on drilling equipment

Compared to other directional drilling techniques

- Continuous core sample from directional sections
- Low water consumption
- All necessary equipment in small start package
- Fits directly on NQ™* or NRQ™* drill string
- High penetration rate in hard rocks
- Easily adjustable and higher possible dogleg due to smoother curvature
- Drill string rotation also during steering
- Directional surveys performed at hole bottom (through DeviDrill bit)
- Full N-size borehole and no additional reaming required

*Q™ is a trademark of Boart Longyear

For construction industry applications

- Continuous core sample from planned tunnel alignment
- Data on the extent and orientation of problematic rock formations
- Information about the mechanical properties of rock formations
- Basis to estimate groundwater inflow, stabilisation measures, and construction costs and duration



Applications

Deviation Control

Boreholes are always influenced by a natural deviation that, if not compensated for, will move the borehole away from its intended target. The DeviDrill can steer a borehole in any given direction and bring it back to the planned path to achieve the required target accuracy.

Most holes will hit their intended target with one DCD correction, but extremely deep holes or in areas with high natural deviation, a second correction will be required as the hole progresses.

The accuracy limits are specified by the project geologists and may vary from project to project. The most common limits requested in Devico projects are:

Depth	Limit (radius)
500m to 1000m	5-15m
1000m and deeper	10-25m

Narrower limits can normally be achieved but may require additional surveying and DCD corrections.

Geotechnical investigation

Using DCD, it is possible to drill along a predefined tunnel alignment, no matter if it is curved or straight. A combination of standard core drilling and DCD is used to first bring the hole on to the alignment and then stay parallel with the alignment, while and at the same time continuously collecting core samples.

With this approach fault zones and fractures are drilled through in the same direction as the planned construction will hit them, giving relevant information about formation size, properties, material, leakage etc.

The core sample, both from the directional and standard drilling process, can be tested in a lab to reveal the mechanical properties of the rock.

Further geophysical and hydrological tests can be performed in the completed borehole. Combined, these tests will significantly improve the geological mapping and reduce the risk of surprises during construction.

Mineral Exploration

DCD allows controlled deviation of the borehole path and drilling of multiple branches from a parent hole, reducing the cost, effort and uncertainty involved in a traditional mineral exploration program.

With branch holes the total drilling length of a exploration program is reduced, while the production rate is kept high.

The savings potential is strongly related to the depth of the exploration area and the density of the drill targets. Deeper orebodies with short distance between targets (step-out distance) are likely to generate higher cost savings than shallow targets.

Specifications

Total weight	57kg/125lbs
Total length	4.5m/14.5ft
Bit diameter	NWL
Reamer diameter	NWL
Tool body diameter	72.0mm/2.83"
Hole diameter	75.7mm/3"
Core diameter	31.5mm/1.24"
Core length	3m/10ft
Instrument barrel length	20cm/8"
Instrument barrel diameter	51mm/2.01"
Pumping/latching unit	Longyear NQ™
Landing ring	Longyear NQ™
Landing indication	Yes
Core block indication	Yes
Pull out by-pass valve	Yes
Uses of additives	Optional
Typical dogleg severity (DLS)	5-9°/30m / 5-9°/100ft
Operating flow	30-50l/min / 8-13gal/min
Operating pressure	20bar + circulation pressure
Feeding force (max)	4500kg/9900lbs
RPM	300-1200

Recommended parameters

Dogleg severity, NWL rods	9° pr. 30m/ 9° pr. 100ft (180m/590ft radius)
RPM	300-800
Feeding force (Bit weight + sliding force)	1500-2500 kg
Typical penetration rate	3m/h / 10ft/h
Typical production rate	9 – 27m/12h/ 30 – 90ft/12h (50% – 75% of conventional wireline drilling)

DCD Services

Devico's DCD services consist of world leading directional core drilling equipment, highly professional field engineers and a strong knowledge base. For every DCD project Devico will deliver:

- Borehole planning before and during project
- Savings analysis for each target
- Control over natural deviation
- Target accuracy within 1% of hole depth
- Borehole branching to reduce amount of drilling
- Daily reports and plots of borehole progress
- Field technicians controlling the DCD, ensuring high quality results
- Strong focus on on-site collaboration and efficient operation
- Assistance in monitoring core orientation and surveying boreholes

Planning services

To investigate the benefit of directional drilling in a specific drilling program, Devico provides a plan estimating the amount of standard and directional drilling required, the metres saved compared to drilling all targets from surface, as well as inclination and azimuth at target intercept.

Plans are based on standard N-size wireline down to the proposed kick-off point. DCD is then initiated and performed until the borehole aims towards the final target, and then finalised with standard wireline core drilling.

When the first target is reached, the mother hole is sidetracked, and the branch hole aimed towards a second target. There are no limits on sidetracks, though 5 to 10 branch holes are the most common.

Typical drilling plan with estimated saving

Toolface (deg)	Dogleg (deg/30m)	Azi (end)	Dip (end)	Dist. DCD (m)	End of Hole (m)	Standard Core Drilling (m)
298	9	327	-66	34	790	754
321	9	312	-56	41	738	220
18	9	329	-48	65	694	138
310	9	310	-49	96	680	314
311	9	311	-37	61	628	222

Total with DCD:	1946
Total with only standard core drilling:	3530
Saved metres:	1584
Total DCD:	297

Start package

When a DCD project is ordered, a start package is sent to the project site.

The Devico field engineer will there assemble the equipment and prepare it for operation. One start package is enough to cover work on up to 3 drill rigs by moving between drill sites whenever a directional correction is necessary. When not in use, the equipment is maintained and kept in a secure container near the field operation.

Inclusions:

- DeviDrill core barrel
- Borehole survey instruments
- Orientation instruments
- Spare parts
- Tools



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